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ABSTRACT

This study presents statistics on the demographic characteristics of the post-doctoral population, on the role of the post-doctoral fellow in the university, and on the financing of post-doctoral education. The definition of a post-doctoral fellow used is a person holding a temporary appointment intended to provide an opportunity for continued collaboration in research with a faculty member. A three-page questionnaire was prepared and sent out to the graduate dean of each participating university for distribution to the department chairmen or heads. Chapters cover: (1) the demographic picture of the post-doctoral population; (2) the role of the post-doctoral fellow in the university; and (3) the financial resources associated with post-doctoral education. Appendices include the questionnaire used in the study and a list of departments within major discipline area. (Author/KE)

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POST-DOCTORAL EDUCATION IN THE ONTARIO UNIVERSITIES 1973-74

by

L. C. Payton

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NATIONAL INSTITUTE OF EDUCATION

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Summary

According to a study published by COU in 1972, there were an estimated 622 post-doctoral fellows in the Ontario universities in 1969-70. The Ontario Council on Graduate Studies at its November, 1973 meeting requested the Research Division to update this study for the current year. Questionnaires were sent out and completed by the chairmen of those departments with post-doctoral fellows. All post-doctoral fellows who had appointments falling within the period May 1 1973 to April 30, 1974 were included in the study (with the exception of post-doctorals in the clinical departments in the medical sciences who were excluded from the study).

In 1973-74 there were 835 post-doctoral fellows in the thirteen Ontario universities (Laurentian University and Wilfrid Laurier University did not report any post-doctoral fellows). This represented an increase of 34% over the period 1969-70 to 1973-74. Toronto alone had 28% of the total reported in 1973-74 and Guelph, McMaster, Toronto, Waterloo and Western together accounted for 72% of the post-doctorals. The six major OCGS discipline categories, humanities and social sciences, physical sciences, mathematical sciences, engineering, life sciences and health sciences, are used in this study. About 56% of the post-doctoral fellows in 1973-74 were in the physical sciences. Three-quarters of the post-doctoral population were in the physical sciences, the mathematical sciences and engineering while the life sciences and health sciences accounted for an additional 22%. Only 20 post-doctoral fellows (2.4% of the total) were found in the humanities and social sciences.

For a large majority of the post-doctoral fellows reported in 1973-74, there was no significant lapse of time between receipt of the PhD degree and commencement of the post-doctoral appointment. Almost 77% were within three years of receipt of the doctoral degree: this figure was only slightly lower than the corresponding figure reported in 1969-70.

In 1973-74 Canadian citizens accounted for 29% of the post-doctoral fellows reported, an increase of 137% over the 1969-70 figure. A further 48.5% of the post-doctorals in 1973-74 were landed immigrants and 21% were classified as foreign. The largest group of non-Canadians came from Asia (25% of the total post-doctoral population), 15% of the total came from the United States, 11% from the United Kingdom and 10% from Europe.

Nearly 42% of the post-doctoral fellows who terminated their appointments in 1973-74 found employment in a university or degree-

granting college. Over 17% found employment in business or industry and a further 12% took post-doctoral appointments at another institution. The corresponding figures in 1969-70 were 59%, 12% and 10%. About 49% of the terminating post-doctorals in 1973-74 found employment in Canada (an increase from 41% in 1969-70), 19% accepted employment in the United States and 8% went to Europe and to Asia.

In 1973-74 over one-half of the post-doctoral appointments were for a duration of 12 months or less and almost one-third were from 13 to 24 months duration. In 1969-70 the situation was reversed, 31% of the appointments were for a duration of 12 months or less and 54% were from 13 to 24 months duration. Almost 35% of the departmental chairmen who reported having post-doctoral fellows in 1973-74 considered that post-doctoral experience was essential in hiring new staff. A further 52% of the chairmen thought that it was advantageous and 13% indicated that it was not important.

In 1973-74 the average annual stipend paid to post-doctoral fellows was $8,804, an increase of only 20% since 1969-70. The average stipends in 1973-74 ranged from a low of $8,389 in the physical sciences to a high of $10,879 in the health sciences. Over 56% of the total monies paid in stipends in 1973-74 came from NRC. An additional 11% came from MRC and the universities themselves contributed 14% of the total.

The operating expenditures associated with post-doctoral fellows were estimated (less the monetary value of the teaching service of the post-doctorals). The net expenditure per post-doctoral fellow in 1973-74 was $13,061, an increase of 25% over the 1969-70 figure. In 1969-70, 45.3% of the net expenditure was contributed by the host university. By 1973-74 the university's contribution had been reduced to 41.8%.

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Introduction

In March, 1972, the Council of Ontario Universities published a study entitled Post-Doctoral Education in the Ontario Universities 1969-70 [1]. This study presented statistics on the demographic characteristics of the post-doctoral population, on the role of the post-doctoral fellow in the university, and on the financing of post-doctoral education. The Ontario Council on Graduate Studies at its November, 1973 meeting, requested the Research Division to undertake a similar study to gather updated statistics for the current year.

In designing the updating study a number of minor changes were made. The original study had relied for a substantial portion of the required data on questionnaires completed by the post-doctoral fellows themselves. This proved to be a cumbersome and time-consuming arrangement, particularly in those cases where the post-doctoral fellow had left the university. As a consequence, completed questionnaires were received from only about 82% of the estimated post-doctoral population. It was therefore decided to ask the chairmen or heads of those departments with post-doctoral fellows to complete all parts of the questionnaire. Consequently, it was not possible to gather information relating to the personal goals and aspirations of the post-doctoral fellows.

The definition of a post-doctoral fellow was altered slightly from the definition that was employed in the 1969 study. For the

purposes of the current study, a post-doctoral fellow was defined to be a person holding a temporary appointment intended to provide an opportunity for continued collaboration in research with a faculty member. The term "post-doctoral fellow" included both "post-doctoral fellows" and "research associates" in the sense used by the National Research Council for the purpose of awarding research grants. This distinction was not employed in any subsequent analysis but was used to ensure that the desired population was reported. A further restriction was added for the current study which stipulated that only post-doctoral fellows who had received their doctoral degrees in the period 1968 to 1974 were to be included. A similar restriction was not employed in the 1969 study but only about 2-3% of the post-doctoral fellows reported would have been rejected had this restriction been used. It was felt that the more precise definition employed in the current study would facilitate reporting by the department chairmen or heads and would have only minimal effects on the statistical comparisons between the two years.

As was the case in the earlier study, the post-doctoral population in the current study excluded post-doctoral fellows in the clinical departments in the medical sciences on the basis that the duties of the post-PhD students in these departments would not likely differ significantly from the duties of the post-MD students. Also excluded were any post-doctoral fellows who were registered in programmes with the graduate schools of the reporting universities. Furthermore, institutions who were

not members of OCGS (OISE, RMC, Ryerson and the church-related universities) were not included in the study; it was felt that not many post-doctoral fellows would be missed because of this limitation.

A three-page questionnaire was prepared and sent out to the graduate dean of each participating university for distribution to the department chairmen or heads. The first page sought general information about the post-doctoral fellows in the department. The second page of the questionnaire sought more specific information on each post-doctoral fellow in the department during the study period. The third page asked for the names of the post-doctoral fellows reported by the department. The department lists for a university were then merged by the graduate office before being returned the the Research Division. This procedure was employed as a means of checking that a post-doctoral fellow was not counted twice if he transferred from one university to another during the study period. (During the subsequent examination of these lists it was determined that double-counting was not a problem in this study.) A copy of the questionnaire is found in Appendix A.

In order to provide a set of current statistics which would be comparable to the 1969-70 figures, a 12-month study period was used as the basis for the data collection rather than a snapshot survey as of a particular date. For the current study all post-doctoral fellows who had appointments falling within the period May 1, 1973, to April 30, 1974, were to be included.

This report will closely follow the presentation of the

earlier report in order to facilitate comparisons over the 5-year period. Chapter 1 presents a demographic picture of the post-doctoral population. The distribution of the post-doctoral fellows among the Ontario universities is shown according to major fields of study; this is the only table in this report showing a breakout by university. The time lapse between receipt of the doctorate and the start of the present post-doctoral appointment is shown. A detailed analysis of the citizenship of the post-doctoral fellows is presented as is the employment obtained by those post-doctoral fellows who completed their appointments during the study period and the countries in which employment was found.

Chapter 2 examines the role of the post-doctoral fellow in the university. Regulations regarding the duration of post-doctoral appointments are compared with the time actually spent during these appointments. The replacement costs of the teaching services performed by the post-doctoral fellows are shown and subjective assessments by the departmental chairmen on the importance of post-doctoral experience in hiring new staff is presented.

Chapter 3 examines the financial resources associated with post-doctoral education. The amounts of the stipends paid to post-doctoral fellows and the sources of these stipends are detailed. These stipends are then compared to the salaries paid to the academic staff in the ranks at which prospective staff with the same qualifications as the post-doctoral fellows

would have been hired. Finally, estimates are made of the operating expenditures relating to post-doctoral education incurred by the Ontario universities.

Chapter 1

The Demography of the Post-doctoral Population

In 1969-70, there were 622 post-doctoral fellows in the Ontario universities. Of the fifteen universities surveyed in the current study, Wilfrid Laurier reported that it had no post-doctoral fellows and no reply was received from Laurentian University. (Laurentian had no post-doctoral fellows in 1969-70.) Replies received from the departmental chairmen or heads at the remaining thirteen institutions indicated that there were 835 post-doctoral fellows in 1973-74. Correspondence with the graduate deans of the universities indicated that one or two small departments did not reply to the study questionnaire but it is felt that the 835 figure is a reasonable estimate.

Post-doctoral fellows in the Ontario universities, then, increased by 34% from 1969-70 to 1973-74. By way of comparison, in the same period full-time undergraduate enrolment in degree programmes in the Ontario universities increased by 26% and full-time graduate enrolment increased by only 7%. However, full-time graduate enrolment actually peaked at a higher level at the start of the present decade and has been on the decline since that time. On the other hand, the number of PhD degrees awarded in 1973-74 was 43% higher than the number awarded in 1969-70 [2]. It would seem likely that the increase in the number of post-doctoral fellows over the five-year period was closely related to the increase in the number of PhD degrees awarded.

Distribution of Post-doctoral Fellows in the Ontario Universities

The 835 post-doctoral fellows reported in 1973-74 were found in 109 departments in the thirteen universities. These departments were classified according to the six major OCGS discipline areas for the purposes of this study. The major discipline areas and the departments within each area which responded to the survey are shown in Appendix B. The list of departments within each discipline area may not necessarily agree with the list used in the 1969-70 study since not all departments reported post-doctoral fellows in both years.

Table 1 shows the distribution of the 835 post-doctoral fellows by university and major discipline area. Looking at the totals for the universities, it is seen that a majority of the post-doctoral fellows were at a few of the larger universities. Toronto alone had 28% of the total and Guelph, McMaster, Toronto, Waterloo and Western together accounted for 72% of the post-doctoral fellows in Ontario universities. Sizable groups of post-doctoral fellows were also found at Carleton, Ottawa, Queen's, Windsor and York.

A few major differences were observed in the distributions by university between 1969-70 and 1973-74. The number of post-doctoral fellows at Guelph tripled over the five-year period and the number at Windsor increased by almost 150%. McMaster on the other hand had about the same number of post-doctorals in both years while the number at Queen's was less in 1973-74. The three

TABLE 1

DISTRIBUTION OF POST-DOCTORAL FELLOWS BY UNIVERSITY

AND FIELD OF STUDY, 1973-74

(FIGURES IN PARENTHESES ARE PERCENTAGES)

	BRO	CAR	GUE	LAK	MCM	OTT	QUE	TOR	TRE	WAT	WES	WIN	YOR	TOTAL	%
HUMANITIES AND SOCIAL SCIENCES		1 (5.0)			4 (20.0)		2 (10.0)	8 (40.0)		1 (5.0)	4 (20.0)			20 (100.0)	2.4
PHYSICAL SCIENCES	2 (0.4)	29 (6.2)	51 (10.9)	3 (0.6)	51 (10.9)	24 (5.1)	35 (7.4)	110 (23.4)	3 (0.6)	28 (6.0)	70 (14.9)	28 (6.0)	36 (7.7)	470 (100.0)	56.3
MATHEMATICAL SCIENCES		9 (15.3)	2 (3.4)		2 (3.4)	2 (3.4)	5 (8.5)	11 (18.6)		20 (33.9)	8 (13.6)			59 (100.0)	7.1
ENGINEERING					14 (13.6)	5 (4.9)	3 (2.9)	32 (31.1)		27 (26.2)	16 (15.5)	6 (5.8)		103 (100.0)	12.3
LIFE SCIENCES	1 (1.0)	8 (8.6)	20 (19.0)		11 (10.5)	14 (13.3)	7 (6.7)	17 (16.2)		3 (2.9)	13 (12.4)		10 (9.5)	105 (100.0)	12.6
HEALTH SCIENCES			4 (5.1)		3 (3.8)	2 (2.6)	2 (2.6)	54 (69.2)			13 (16.7)			78 (100.0)	9.3
TOTAL	3 (0.4)	48 (5.7)	77 (9.2)	3 (0.4)	85 (10.2)	47 (5.6)	54 (6.5)	232 (27.8)	3 (0.4)	79 (9.5)	124 (14.9)	34 (4.1)	46 (5.5)	835 (100.0)	100.0

smaller universities, Brock, Lakehead and Trent, all had fewer post-doctoral fellows in 1973-74 than in 1969-70.

The discipline totals show that about 56% of the post-doctoral fellows in 1973-74 were found in the physical sciences. The physical sciences together with the mathematical sciences and engineering accounted for three-quarters of the post-doctoral population while the life sciences and health sciences accounted for another 22%. Only 20 post-doctoral fellows (representing 2.4% of the total) were found in the humanities and social sciences, a decline from 21 post-doctoral fellows and 3.4% of the total in 1969-70. The only other significant changes between the two years were a decrease in the percentage of post-doctorals in the life-sciences (15.4% of the total in 1969-70 to 12.6% in 1973-74) and an increase in the health sciences (from 5.8% in 1969-70 to 9.3% in 1973-74).

Time Between Receipt of PhD and Commencement of Post-doctoral Appointment

The department chairmen indicated for each post-doctoral fellow the year in which the PhD degree had been received. The year in which the degree was received refers to the calendar year, so it is possible for a post-doctoral fellow to have received his degree in 1974 and still have begun his post-doctoral appointment within the study period. This information was reported for 817 of the post-doctoral fellows; the results are tabulated by discipline area in Table 2.

TABLE 2

DISTRIBUTION OF POST-DOCTORAL FELLOWS BY YEAR IN WHICH PhD WAS OBTAINED AND FIELD OF STUDY, 1973-74
(FIGURES IN PARENTHESES ARE PERCENTAGES)

	CALENDAR YEAR IN WHICH PhD WAS OBTAINED							
	1968	1969	1970	1971	1972	1973	1974	TOTAL
HUMANITIES AND SOCIAL SCIENCES	1 (5.0)		1 (5.0)	3 (15.0)	2 (10.0)	10 (50.0)	3 (15.0)	20 (100.0)
PHYSICAL SCIENCES	26 (5.6)	36 (7.7)	64 (13.7)	91 (19.4)	117 (25.0)	122 (26.1)	12 (2.6)	468 (100.0)
MATHEMATICAL SCIENCES	4 (6.8)	3 (5.1)	7 (11.9)	8 (13.6)	17 (28.8)	20 (33.9)		59 (100.0)
ENGINEERING	1 (1.1)	4 (4.3)	5 (5.4)	11 (12.0)	30 (32.6)	36 (39.1)	5 (5.4)	92 (100.0)
LIFE SCIENCES	5 (5.0)	8 (7.9)	8 (7.9)	17 (16.8)	30 (29.7)	27 (26.7)	6 (5.9)	101 (100.0)
HEALTH SCIENCES	2 (2.6)	4 (5.2)	10 (13.0)	14 (18.2)	23 (29.9)	22 (28.6)	2 (2.6)	77 (100.0)
TOTAL	39 (4.8)	55 (6.7)	95 (11.6)	144 (17.6)	219 (26.8)	237 (29.0)	28 (3.4)	817 (100.0)

Looking at the totals for all disciplines, it is seen that 29% of the post-doctorals in 1973-74 received their PhD in 1973. Nearly 27% received their degree in the previous year and a further 18% in 1971. Of the post-doctoral fellows holding appointments during 1973-74, almost 77% were within three years of receipt of the doctoral degree. This figure is only two percentage points lower than the corresponding figure reported in 1969-70; this difference might be attributed to the different start dates for the study periods (July 1, 1969 and May 1, 1973). In any case the patterns appear to be quite similar.

The only discipline which showed a significant deviation from this pattern was the humanities and social sciences. Post-doctoral fellows in this discipline tended to be more recent PhD graduates than in the other disciplines. This observation, however, may simply result because of the small number of post-doctorals in this discipline area.

As was the case in 1969, it would appear that there was not a significant lapse of time in general between receipt of the PhD degree and commencement of post-doctoral appointments.

Citizenship of the Post-doctoral Fellows

In the 1969-70 study only 12% of the post-doctoral fellows were Canadian citizens. For the 1973-74 study the departmental chairmen were asked to record for each post-doctoral fellow the country of citizenship, and in the case of non-Canadians, the visa status in Canada. Complete or partial responses were received for

TABLE 3

DISTRIBUTION OF POST-DOCTORAL FELLOWS BY CITIZENSHIP STATUS, COUNTRY OF CITIZENSHIP AND FIELD OF STUDY, 1973-74

(FIGURES IN PARENTHESES ARE PERCENTAGES)

	CITIZENSHIP STATUS AND COUNTRY OF CITIZENSHIP														
	CANADA	LANDED IMMIGRANT						FOREIGN						CITIZENSHIP STATUS NOT REPORTED	TOTAL
		USA	UK	EUROPE	ASIA	OTHER	SUB-TOTAL	USA	UK	EUROPE	ASIA	OTHER	SUB-TOTAL		
HUMANITIES AND SOCIAL SCIENCES	9 (45.0)	3 (15.0)	3 (15.0)				6 (30.0)	3 (15.0)		1 (5.0)			4 (20.0)	1 (5.0)	20 (100.0)
PHYSICAL SCIENCES	119 (25.3)	54 (11.5)	50 (10.6)	25 (5.3)	97 (20.6)	24 (5.1)	250 (53.2)	26 (5.5)	12 (2.6)	26 (5.5)	20 (4.3)	8 (1.7)	92 (19.6)	9 (1.9)	470 (100.0)
MATHEMATICAL SCIENCES	21 (35.6)	6 (10.2)		1 (1.7)	7 (11.9)	3 (5.1)	17 (28.8)	5 (8.5)	3 (5.1)	3 (5.1)	3 (5.1)	7 (11.9)	21 (35.6)		59 (100.0)
ENGINEERING	21 (21.4)		2 (2.0)	6 (6.1)	25 (25.5)	15 (15.3)	48 (49.0)	2 (2.0)	1 (1.0)	4 (4.1)	18 (18.4)	2 (2.0)	27 (27.6)	2 (2.0)	98 (100.0)
LIFE SCIENCES	30 (29.4)	9 (8.8)	10 (9.8)	5 (4.9)	19 (18.6)	7 (6.9)	50 (49.0)	6 (5.9)	3 (2.9)	3 (2.9)	2 (2.0)	2 (2.0)	16 (15.7)	6 (5.9)	102 (100.0)
HEALTH SCIENCES	37 (48.1)	5 (6.5)	7 (9.1)	3 (3.9)	12 (15.6)	3 (3.9)	30 (39.0)	1 (1.3)		4 (5.2)	4 (5.2)	1 (1.3)	10 (13.0)		77 (100.0)
TOTAL	237 (28.7)	77 (9.3)	72 (8.7)	40 (4.8)	160 (19.4)	52 (6.3)	401 (48.5)	43 (5.2)	19 (2.3)	41 (5.0)	47 (5.7)	20 (2.4)	170 (20.6)	18 (2.2)	826 (100.0)

826 post-doctoral fellows; the resulting tabulation is presented in Table 3.

This table shows that there has been a considerable change in the citizenship of the post-doctoral fellows. In 1973-74 Canadian citizens accounted for 29% of the total population, an increase of 137% over the 1969-70 figure. A further 48.5% of the post-doctoral fellows were landed immigrants and 21% were classified as foreign (down from 32% in 1969-70). Canadian citizens and landed immigrants together accounted for 77% of the post-doctoral fellows. As was the case in 1969-70, the physical sciences and engineering had the lowest Canadian content (25% and 21% respectively). The health sciences and humanities and the social sciences showed the highest Canadian content with Canadian citizens accounting for 48% and 45% of the post-doctoral fellows in these respective disciplines.

By way of comparison, in 1973-74, 87% of Ontario full-time graduate students were either Canadian citizens or landed immigrants and 13% were foreign [3].

By far the greatest number of landed immigrants were from Asia, representing over 19% of all post-doctoral fellows. The United States accounted for an additional 9% as did the United Kingdom. Landed immigrants accounted for 29% of the post-doctoral fellows in the mathematical sciences and for 30% in the humanities and social sciences. In the remaining discipline areas, 39 to 53% of the post-doctorals were in the landed immigrant category.

Of the post-doctoral fellows who were classified as foreign, there were representations of 5 to 6% of the total post-doctoral population from the United States, from Europe and from Asia. The health sciences had the lowest foreign content (13% of the post-doctorals in this discipline) and the mathematical sciences had the highest foreign content at 36%. Engineering also had a high foreign content; two-thirds of these fellows were from Asia.

Examining the origins of the post-doctoral fellows who were not Canadian citizens (i.e. either foreign or landed immigrants), we see that by far the largest group came from Asia (25% of the total post-doctoral population). The United States was next with 15% of the total, followed by the United Kingdom with 11% and Europe with 10%. In 1969-70 there was a somewhat different pattern with 26% of the post-doctoral fellows from Asia, 25% from the United Kingdom, 19% from Europe and 10% from the United States. In the five-year period the percentages of post-doctoral fellows from the United Kingdom and Europe have been halved while the percentage from Asia remained about the same and the percentage from the United States increased.

The increased Canadianization of the post-doctoral population is not unexpected when one examines the pattern of post-doctorate fellowship awards by NRC. In 1969-70 only 15.5% of the 220 fellowships awarded were held at Canadian universities. NRC awarded 226 post-doctorate fellowships in 1973-74; the location of tenure was not indicated for 50 of these awards. Of the remaining 176

fellowships awarded, 49% were held in Canadian institutions [4]. (The fact that more NRC awards are being held at Canadian universities is a result of policy changes on NRC's part. At present NRC insists that all candidates for its post-doctoral fellowships provide detailed information concerning the location of proposed tenure at the time of application. Furthermore, candidates who have received their predoctoral degrees from foreign universities and those who have received or who are about to receive their doctoral degree from foreign universities will not in most cases be considered for awards tenable at institutions outside Canada.)

Somewhat similar findings have been presented for Ontario by OCGS. In 1969-70, 169 graduating PhD's from Ontario universities accepted post-doctoral appointments, 49% of these appointments were held at Canadian universities. Of the 192 graduating PhDs who accepted post-doctoral appointments in 1973-74, 66% of the appointments were held in Canadian universities. Canadian citizens and landed immigrants accounted for 90% of these post-doctoral appointments held in Canadian institutions [5].

The above statistics would seem to indicate that the Canadian content of the post-doctoral population will continue to increase. However, it must also be remembered that a large number of Canadian doctorate recipients continue to go abroad to undertake their post-doctoral training.

Employment Found by Post-doctoral Fellows

We have seen that a large number of doctorate holders have decided that their academic development is not complete upon receipt of the PhD degree and have accordingly taken post-doctoral appointments. We will now examine where the post-doctoral fellows found employment upon completion of these appointments. The departmental chairmen were asked to indicate the organizations in which employment was obtained by those post-doctoral fellows who terminated their appointments during the academic year 1973-74. A list of categories was provided on the questionnaire sent to each department. A tabulation of the responses is presented in Table 4.

Of the 333 post-doctoral fellows who were reported as having terminated their appointments, nearly 42% found employment in a university or degree-granting college. This figure was considerably lower than the 59% who found similar employment in 1969-70. The disciplines with the highest percentage of their terminating post-doctorals in this category were the humanities and social sciences (78%) and the health sciences (68%). The remaining disciplines showed much lower percentages, only about a third of the terminating post-doctoral fellows in the physical sciences found employment in a university or degree-granting college.

Over 17% of the post-doctorals who terminated their appointments found employment in business or industry. This figure was 5 percentage points higher than the corresponding figure in 1969-70.

TABLE 4

ORGANIZATIONS IN WHICH EMPLOYMENT WAS OBTAINED UPON

COMPLETION OF PRESENT POST-DOCTORAL APPOINTMENTS, 1973-74

(FIGURES IN PARENTHESES ARE PERCENTAGES)

	UNIVERSITY OR COLLEGE	NON-DEGREE POST-SECONDARY INST.	HIGH SCHOOL	BUSINESS OR INDUSTRY	FEDERAL OR PROVINCIAL GOVERNMENT	POST-DOCTORAL WORK	NON-PROFIT ORGANIZATION	SELF-EMPLOYMENT	OTHER	NOT KNOWN	TOTAL
HUMANITIES AND SOCIAL SCIENCES	7 (77.8)			1 (11.1)						1 (11.1)	9 (100.0)
PHYSICAL SCIENCES	55 (32.4)	1 (0.6)	2 (1.2)	36 (21.2)	21 (12.4)	30 (17.6)	2 (1.2)	1 (0.6)	8 (4.7)	14 (8.2)	170 (100.0)
MATHEMATICAL SCIENCES	24 (55.8)		1 (2.3)	3 (7.0)		4 (9.3)			3 (7.0)	8 (18.6)	43 (100.0)
ENGINEERING	23 (46.9)			14 (28.6)	5 (10.2)	3 (6.1)			1 (2.0)	3 (6.1)	49 (100.0)
LIFE SCIENCES	15 (37.5)			2 (5.0)	5 (12.5)	3 (7.5)	1 (2.5)	1 (2.5)	7 (17.5)	6 (15.0)	40 (100.0)
HEALTH SCIENCES	15 (68.2)	1 (4.5)		2 (9.1)	2 (9.1)			1 (4.5)	1 (4.5)		22 (100.0)
TOTAL	139 (41.7)	2 (0.6)	3 (0.9)	58 (17.4)	33 (9.9)	40 (12.0)	3 (0.9)	3 (0.9)	20 (6.0)	32 (9.6)	333 (100.0)

As might be expected, the disciplines with the highest percentage of terminating post-doctorals in this category were engineering with 29% and the physical sciences with 21%. Twelve percent of the terminating post-doctoral fellows took post-doctoral appointments at another institution, approximately the same percentage as in 1969-70. Nearly 18% of the terminating post-doctorals in the physical sciences fell into this category. Another 10% of the terminating post-doctorals found employment in federal or provincial government service.

These figures for 1973-74 may reflect a slight downward bias as the employment found by nearly 10% of the terminating post-doctoral fellows was reported as "not known". However, in general it would appear that a higher proportion of post-doctoral fellows found employment in the non-university sector than in 1969-70.

Country in Which Employment Was Obtained

Having seen the types of employment obtained by the post-doctoral fellows who terminated their appointments in 1973-74, we will now examine where this employment was found. This information was also obtained from the departmental chairmen, the results are shown in Table 5.

In 1973-74, 49% of the terminating post-doctoral fellows found employment in Canada, an increase from 41% in 1969-70. The percentage was highest in the humanities and social sciences (56%) but this was considerably below the figure of 75% reported in 1969-70. The lowest percentage was in the mathematical sciences

TABLE 5

COUNTRY OF EMPLOYMENT UPON COMPLETION

OF POST-DOCTORAL APPOINTMENT, 1973-74

(FIGURES IN PARENTHESES ARE PERCENTAGES)

	CANADA	USA	UK	EUROPE	ASIA	AFRICA	OTHER	NOT KNOWN	TOTAL
HUMANITIES AND SOCIAL SCIENCES	5 (55.6)	2 (22.2)		1 (11.1)				1 (11.1)	9 (100.0)
PHYSICAL SCIENCES	85 (49.4)	40 (23.3)	9 (5.2)	14 (8.1)	9 (5.2)	4 (2.3)	7 (4.1)	4 (2.3)	172 (100.0)
MATHEMATICAL SCIENCES	20 (46.5)	8 (18.6)	3 (7.0)	2 (4.7)	2 (4.7)	1 (2.3)	3 (7.0)	4 (9.3)	43 (100.0)
ENGINEERING	23 (46 9)	7 (14.3)	1 (2.0)	4 (8.2)	8 (16.3)	2 (4.1)		4 (8.2)	49 (100.0)
LIFE SCIENCES	20 (51.3)	4 (10.3)	1 (2.6)	2 (5.1)	4 (10.3)	1 (2.6)	4 (10.3)	3 (7.7)	39 (100.0)
HEALTH SCIENCES	11 (47.8)	4 (17.4)	1 (4.3)	2 (8.7)	3 (13.0)		2 (8.7)		23 (100.0)
TOTAL	164 (49.0)	65 (19.4)	15 (4.5)	25 (7.5)	26 (7.8)	8 (2.4)	16 (4.8)	16 (4.8)	335 (100.0)

(46.5% found employment in Canada).

The country which received the next highest percentage of terminating post-doctoral fellows was the United States. Over 19% of the post-doctorals accepted employment in the United States in 1973-74, about the same as the 18% reported in 1969-70. The percentage was highest in the physical sciences (23%) and lowest in the life sciences (10%). Interestingly, in 1969-70 one-quarter of the terminating post-doctorals in the life sciences went to the United States, by far the highest percentage in any discipline. Approximately 8% of the post-doctorals who terminated their appointments in 1973-74 went to Europe and to Asia for employment. This figure represented a slight increase over 1969-70 in the percentage going to Asia but was a significant decrease in the percentage taking employment in Europe.

In examining the figures which showed where employment was found by the terminating post-doctoral fellows, we must bear in mind the fact that 29% of the post-doctorals in the Ontario universities in 1973-74 were Canadian citizens and a further 48.5% were landed immigrants. If we assume that a large proportion of the foreign post-doctoral fellows returned to their home countries upon completion of their appointments, and that not all of the terminating Canadian post-doctorals found employment in Canada, then, a large proportion of the terminating landed immigrants (perhaps 40 to 50%) remained in Canada.

Chapter 2

The Post-doctoral Fellow in the Ontario Universities

In the previous chapter we examined some of the background characteristics of the post-doctoral population in the Ontario universities. In this chapter detail on the nature of the post-doctoral fellows' position in the universities will be presented.

Time Limits on Appointments

Given that a large number of doctorate recipients continue their academic development by taking post-doctoral training, it is important to consider the length of time that should be spent on these studies. This question will be looked at from two points of view: the time limits imposed by the university departments and the actual durations of post-doctoral appointments. The departmental chairmen were asked to indicate how long post-doctoral fellows could remain in their departments. The responses are tabulated in Table 6.

Ninety-eight departmental chairmen replied to this question. Nearly 43% indicated that there was no time limit in their departments. (This percentage was more than double the percentage reported in 1969-70.) The percentage varied from a low of 29% in the health sciences to 55% in the life sciences. About one-third of the reporting departments indicated that they had a time limit of two years (considerably below the figure of 52% in 1969-70). This varied from 25% in the life sciences to 50%

TABLE 6

MAXIMUM LENGTH OF TIME POST-DOCTORALS MAY CONTINUE IN A DEPARTMENT AS REPORTED BY DEPARTMENTAL CHAIRMEN, 1973-74

(FIGURES IN PARENTHESES ARE PERCENTAGES)

	TIME LIMIT						NO. OF DEPARTMENTS REPORTING
	1 YEAR	2 YEARS	3 YEARS	4 YEARS	5 YEARS	NO LIMIT	
HUMANITIES AND SOCIAL SCIENCES		2 (50.0)				2 (50.0)	4 (100.0)
PHYSICAL SCIENCES		9 (31.0)	7 (24.1)	3 (10.3)		10 (34.5)	29 (100.0)
MATHEMATICAL SCIENCES		6 (46.2)	1 (7.7)			6 (46.2)	13 (100.0)
ENGINEERING	2 (13.3)	4 (26.7)	1 (6.7)			8 (53.3)	15 (100.0)
LIFE SCIENCES	1 (5.0)	5 (25.0)	2 (10.0)	1 (5.0)		11 (55.0)	20 (100.0)
HEALTH SCIENCES		6 (35.3)	5 (29.4)		1 (5.9)	5 (29.4)	17 (100.0)
TOTAL	3 (3.1)	32 (32.7)	16 (16.3)	4 (4.1)	1 (1.0)	42 (42.9)	98 (100.0)

in the humanities and social sciences. A time limit of 3 years was imposed by 16% of the departments. The percentage ranged from 7% in engineering to over 29% in the health sciences. In general, it would appear that in 1973-74 more university departments permitted longer post-doctoral appointments than was the case in 1969-70.

The departmental chairmen were asked (if in the previous question they had indicated that a time limit on post-doctoral appointments existed) if the time limit was a policy of their university. Only five of the sixty-three departments answering this question indicated that a university policy did exist. Some confusion seems to exist however, because in all five cases other departments in the same universities had replied that no university policy existed. There would not appear to be any uniform policy in the Ontario universities regarding the duration of post-doctoral appointments. Rather the duration is a matter of individual department policy.

Duration of Appointments

We have seen in the previous section that departmental chairmen imposed fewer time limits on post-doctoral appointments in 1973-74 than in 1969-70. By way of comparison we will now look at the actual duration of the post-doctoral appointments. The departmental chairmen were asked to indicate for each post-doctoral fellow the dates on which the present appointment began and terminated. For this question the present appointment was

TABLE 7

EXPECTED DURATION OF POST-DOCTORAL APPOINTMENTS, 1973-74

(FIGURES IN PARENTHESES ARE PERCENTAGES)

	EXPECTED DURATION OF APPOINTMENT (MONTHS)													
	1-3	4-6	7-9	10-12	13-15	16-18	19-21	22-24	25-27	28-30	31-33	34-36	37+	TOTAL
HUMANITIES AND SOCIAL SCIENCES		4 (20.0)	6 (30.0)	4 (20.0)	1 (5.0)		4 (20.0)	1 (5.0)						20 (100.0)
PHYSICAL SCIENCES	23 (4.9)	55 (11.7)	103 (21.9)	61 (13.0)	30 (6.4)	42 (8.9)	68 (14.5)	23 (4.9)	14 (3.0)	5 (1.1)	19 (4.0)	10 (2.1)	17 (3.6)	470 (100.0)
MATHEMATICAL SCIENCES		5 (8.5)	27 (45.8)	10 (16.9)			13 (22.0)	3 (5.1)				1 (1.7)		59 (100.0)
ENGINEERING	15 (14.6)	16 (15.5)	27 (26.2)	14 (13.6)	10 (9.7)	5 (4.9)	5 (4.9)	4 (3.9)	2 (1.9)	3 (2.9)	1 (1.0)		1 (1.0)	103 (100.0)
LIFE SCIENCES	13 (12.4)	5 .8)	19 (18.1)	18 (17.1)	11 (10.5)	8 (7.6)	6 (5.7)	9 (8.6)	4 (3.8)	5 (4.8)	3 (2.9)	1 (1.0)	3 (2.9)	105 (100.0)
HEALTH SCIENCES	4 (5.2)	4 (5.2)	10 (13.0)	17 (22.1)	4 (5.2)	6 (7.8)	12 (15.6)	5 (6.5)	8 (10.4)	2 (2.6)	4 (5.2)	1 (1.3)		77 (100.0)
TOTAL	55 (6.6)	89 (10.7)	192 (23.0)	124 (14.9)	56 (6.7)	61 (7.3)	108 (12.9)	45 (5.4)	28 (3.4)	15 (1.8)	27 (3.2)	13 (1.6)	21 (2.5)	834 (100.0)

NOTE: The figures reported in this table reflect a downward bias arising from the method of data collection employed.

defined as the time spent in post-doctoral study in the same department at the same university. If a post-doctoral fellow had not terminated his appointment by the end of the study period, the departmental chairmen were asked to indicate April, 1974, as the termination date, rather than attempt to estimate the actual completion date of the appointment. It was recognized that this would introduce a downward bias in the figures but it was felt that this was preferable to the inconsistency in reporting which might otherwise result. The responses to this question are presented in Table 7.

Before examining the figures in Table 7 it will be useful to attempt to estimate the degree of bias. A table similar to Table 7 was calculated for those post-doctoral fellows who had terminated their appointments prior to April, 1974. The percentage figures in this table were quite similar to the percentages in Table 7, but were shifted to the right by approximately one interval. We would, therefore, estimate that on average the downward bias is of the order of 2 to 3 months.

With this in mind, it can be seen from the figures in Table 7 that the largest percentages of post-doctoral appointments lasted approximately one or two years. This would seem to reflect the policy of the two major external granting agencies, NRC and the Medical Research Council, whose post-doctoral fellowships are awarded for a period of one year with an option for renewal of one year if satisfactory progress is reported. Over one-half

of the appointments were for a duration of 12 months or less and almost one-third were from 13 to 24 months duration. This is a complete reversal of the situation which existed in 1969-70. In that year 31% of the appointments were for a duration of 12 months or less and 54% were from 13 to 24 months duration. Only about 13% of the post-doctoral appointments in 1973-74 lasted more than two years (a similar figure was reported in 1969-70).

There were some interesting differences among the discipline groups in the 1973-74 figures. In the humanities and social sciences no post-doctoral appointments lasted beyond two years. The mathematical sciences showed by far the highest concentration of appointments of approximately one-year duration. Post-doctoral appointments in the health sciences tended to be above average duration and there was the highest percentage of appointments lasting more than two years in this discipline.

While exact comparisons between the figures reported for 1969-70 and 1973-74 are difficult to make because of the differences in data collection, there can be no mistaking the trend over the period towards post-doctoral appointments of shorter duration.

Replacement Value of the Post-doctorals' Teaching Service

Post-doctoral students constitute a source of highly qualified manpower and it would seem likely that the universities would make use of this resource. To see if this was indeed the case the

TABLE 8

REPLACEMENT COST OF THE TEACHING SERVICE

OF POST-DOCTORAL FELLOWS, 1973-74

	NUMBER OF FACULTY	COST OF FACULTY	NO. OF DEPARTMENTS REPORTING
HUMANITIES AND SOCIAL SCIENCES	5.0	$ 63,038	5
PHYSICAL SCIENCES	47.4	675,507	20
MATHEMATICAL SCIENCES	15.1	232,000	10
ENGINEERING	7.0	100,000	2
LIFE SCIENCES	5.2	75,000	6
HEALTH SCIENCES	10.7	205,000	4
TOTAL	90.4	$1,350,545	47

departmental chairmen were asked to indicate how many full-time academic staff they would have needed to replace the teaching done by their post-doctoral fellows and the costs of these additional staff. Forty-seven departments indicated that they would have required additional teaching staff; of the fifty-eight departments who reported that they would not have required additional teaching staff, a majority indicated that their present post-doctoral fellows did not engage in teaching duties. The resulting tabulation for the forty-seven departments is shown in Table 8.

The forty-seven departments stated that they would have needed an additional 90 academic staff members at a cost of 1.35 million dollars to replace the teaching service of their post-doctoral fellows. This compares with the sixty-five new staff needed at a cost of eight hundred thousand dollars reported in 1969-70. However, it cannot be assumed that all of the teaching duties performed by the post-doctoral fellows would have been taken over by these additional members of staff. It is possible that some of the duties would have fallen to graduate students or to present members of the academic staff.

Importance of Post-doctoral Experience in Hiring

Judging by the number of post-doctoral fellows in Ontario universities it would seem that a significant number of PhD recipients have felt that post-doctoral experience was important to their career plans. To determine if this viewpoint was shared

TABLE 9

IMPORTANCE OF POST-DOCTORAL EXPERIENCE IN HIRING NEW STAFF AS REPORTED BY DEPARTMENTAL CHAIRMEN, 1973-74

(FIGURES IN PARENTHESES ARE PERCENTAGES)

	ESSENTIAL	ADVANTAGEOUS	NOT IMPORTANT	NO. OF DEPARTMENTS REPORTING
HUMANITIES AND SOCIAL SCIENCES	1 (16.7)	4 (66.7)	1 (16.7)	6 (100.0)
PHYSICAL SCIENCES	22 (64.7)	9.5 (27.9)	2.5 (7.4)	34 (100.0)
MATHEMATICAL SCIENCES	1 (7.7)	9 (69.2)	3 (23.1)	13 (100.0)
ENGINEERING		11 (68.8)	5 (31.2)	16 (100.0)
LIFE SCIENCES	6 (26.1)	15 (65.2)	2 (8.7)	23 (100.0)
HEALTH SCIENCES	8 (44.4)	9 (50.0)	1 (5.6)	18 (100.0)
TOTAL	38 (34.5)	57.5 (52.3)	14.5 (13.2)	110 (100.0)

by the departmental chairmen, who have a major role in hiring decisions, we asked the departmental chairmen if they thought that post-doctoral experience was essential, advantageous, or not important in hiring new staff. Replies were received from 110 departments, but in a few cases more than one category had been indicated. When this was done the choices were given equal weighting and the appropriate fraction was entered in the indicated categories. The resulting tabulation is presented in Table 9.

The results show that there is a definite benefit in having post-doctoral experience. Almost 35% of the chairmen's responses stated that post-doctoral experience was essential, 52% considered it to be advantageous, and 13% of the responses indicated that it was not important. However, this endorsement of the value of post-doctoral experience is not as positive in some respects as the replies received in 1969-70. In that year only 3% of the departmental chairmen felt that it was not important. Over 26% thought that it was essential and a further 71% felt it to be advantageous.

In the 1973-74 figures there are some differences in the discipline responses. The physical sciences showed by far the highest percentage of departmental chairmen who considered post-doctoral experience to be essential (65%). About two-thirds of the chairmen in the humanities and social sciences, in the mathematical sciences, in engineering and in the life sciences thought that it was advantageous. The highest percentage of

chairmen who regarded post-doctoral experience as not important was found in the mathematical sciences (23%).

Chapter 3

The Financing of Post-doctoral Education

In the previous chapter the role of the post-doctoral fellow in the university was examined. In this chapter the cost associated with post-doctoral education in the Ontario universities will be analysed. This analysis will first examine the monetary rewards and losses of the post-doctoral fellows themselves. The final section of this chapter will estimate the operating expenditures of the Ontario universities which are directed to post-doctoral education.

Post-doctoral Stipends

During the eight to ten years spent in university in pursuit of the PhD degree, the annual income of a student at best will only have covered his basic living expenses and the costs of his education. Furthermore, it is reasonable to expect that a number of these graduating PhDs will be married and have families. One might then expect that a level of support higher than that received during the doctoral training must be offered by the universities and granting agencies if PhD holders are to be induced to remain in the university and undertake post-doctoral research.

To determine actual levels of support, the departmental chairmen were asked to list for each of their post-doctoral fellows the annual amounts of any stipends, awarded salaries, fellowships or payments for teaching received during the academic year 1973-74 together with the granting agencies in each case. Replies were

TABLE 10

DISTRIBUTION OF POST-DOCTORAL STIPENDS, 1973-74

(FIGURES IN PARENTHESES ARE PERCENTAGES)

	VALUE OF STIPEND (DOLLARS/ANNUM)												
	0-3999	4000-4999	5000-5999	6000-6999	7000-7999	8000-8999	9000-9999	10000-10999	11000-11999	12000-12999	13000 +	TOTAL	AVERAGE STIPEND
HUMANITIES AND SOCIAL SCIENCES	1 (5.6)	2 (11.1)				5 (27.8)	3 (16.7)	4 (22.2)	3 (16.7)			18 (100.0)	8795
PHYSICAL SCIENCES	6 (1.4)	7 (1.6)	7 (1.6)	19 (4.3)	76 (17.1)	240 (54.1)	41 (9.2)	24 (5.4)	6 (1.4)	14 (3.2)	4 (0.9)	444 (100.0)	8389
MATHEMATICAL SCIENCES		1 (1.8)	1 (1.8)	1 (1.8)	8 (14.3)	18 (32.1)	12 (21.4)	5 (8.9)	4 (7.1)	1 (1.8)	5 (8.9)	56 (100.0)	9387
ENGINEERING		2 (2.0)	2 (2.0)	2 (2.0)	15 (14.9)	46 (45.5)	13 (12.9)	8 (7.9)	2 (2.0)	9 (8.9)	2 (2.0)	101 (100.0)	8903
LIFE SCIENCES		1 (1.0)	4 (4.0)	8 (8.1)	5 (5.1)	46 (46.5)	15 (15.2)	13 (13.1)	5 (5.1)		2 (2.0)	99 (100.0)	8668
HEALTH SCIENCES				2 (2.7)	1 (1.3)	19 (25.3)	20 (26.7)	15 (20.0)	5 (6.7)	6 (8.0)	7 (9.3)	75 (100.0)	10879
TOTAL	7 (0.9)	13 (1.6)	14 (1.8)	32 (4.0)	105 (13.2)	374 (47.2)	104 (13.1)	69 (8.7)	25 (3.2)	30 (3.8)	20 (2.5)	793 (100.0)	8804

received for 793 (95%) of the post-doctoral fellows; the tabulated results are presented in Table 10.

In 1973-74, the average value of the annual stipend paid to post-doctoral fellows was $8,804. This represented an increase over the average annual stipend paid in 1969-70 ($7,335.) of only 20% in a period which in the most recent years has been characterized by double digit inflation annually and high salary settlements in many sectors of the labour market. Furthermore, many post-doctoral fellows enjoyed tax exemptions on their post-doctoral fellowships in 1969-70, and these exemptions have since been removed by the federal legislature. In terms of purchasing power, many of the post-doctoral fellows in Ontario universities in 1973-74 likely received a lower level of support than did their counterparts in 1969-70. Over the five-year period it would seem that granting agencies were unable to maintain a consistent level of support in terms of real purchasing power and at the same time make approximately the same number of awards available each year for post-doctoral study.

Turning again to Table 10, it is seen that the highest average stipends were received by post-doctoral fellows in the health sciences, the average value being $10,879. (an increase of 47% over the average stipend in the health sciences in 1969-70). Fellows in the mathematical sciences were next with an average stipend of $9,387. (up 16% from 1969-70). As was also the case in 1969-70, the lowest stipends were paid to post-doctoral fellows

TABLE 11

AVERAGE SALARIES OF FULL-TIME ACADEMIC STAFF

IN ONTARIO UNIVERSITIES IN 1969-70 AND 1973-74

(EXCLUDING MEDICINE)

	1969-70	1973-74	
	AVERAGE SALARY	AVERAGE SALARY	10th PERCENTILE
PROFESSOR	20,841	26,528	21,450
ASSOCIATE PROFESSOR	15,273	18,911	16,250
ASSISTANT PROFESSOR	12,076	15,104	13,000
LECTURER	9,918	12,220	10,300
INSTRUCTOR	8,312	11,692	7,589
TOTAL	14,400	18,925	

SOURCES: 1969-70 UA1 anticipated actual submissions to the Department of University Affairs.

1973-74 Statistics Canada Salary Analysis System.

in the physical sciences, $8,389. on average. Although the average stipend of $8,795 in the humanities and social sciences was not the lowest, it represented an increase of only 2% over the 1969-70 average in this discipline.

The total value of the stipend is not the only criterion that must be examined in determining its attractiveness. We should also look at its relationship to academic salaries in the province. Table 11 presents average salaries for ranked academic staff in the Ontario universities (excluding staff in the Faculties of Medicine) for 1973-74 with comparative figures for 1969-70.

Two factors must be borne in mind while examining the figures in Table 11. First, starting salaries would have been somewhat below the average salary figures shown in the table. Second, nearly three-quarters of the reporting departmental chairmen in the 1969-70 study indicated that faculty members with the same professional experience as their current post-doctoral fellows would have been hired at the rank of assistant professor. As the average post-doctoral stipend in 1969-70 was $7,335, for many post-doctoral fellows (in particular those enjoying tax exemptions) the post-doctoral stipends would have compared favourably with starting salaries at the rank of assistant professor and below. For 1973-74, 10th percentile salaries have been presented, in addition to the averages, as it was felt that the 10th percentile salaries would be closer to starting salaries. On examining the

1973-74 figures it would appear that for a majority of post-doctoral fellows the post-doctoral stipends would not be as attractive in relation to starting salaries. The gap between stipends and salaries appears to have widened.

Sources of Stipends

The annual stipends reported by the departmental chairmen for their post-doctoral fellows have been reduced where necessary to reflect the actual number of months during the study period that these fellows held their appointments and would have received payments. The resulting figures have been grouped according to funding agency and are presented in Table 12.

A total of 4.74 million dollars was paid in stipends to Ontario post-doctoral fellows in 1973-74, an increase of 76% over 1969-70. Over 56% of this amount came from NRC (an increase in NRC's portion from 48% in 1969-70). This is not surprising considering the heavy concentration of post-doctoral fellows in the science-oriented disciplines. An additional 11% of the total stipend monies came from MRC which represented an increase over 1969-70 of two percentage points. The MRC contribution was directed mainly to post-doctoral fellows in the life sciences and the health sciences. The Canada Council's contribution represented less than 1% of the total and did not include any funding for fellows in the humanities and social sciences. The universities themselves accounted for 14% of the total stipend

TABLE 12

SOURCES OF POST-DOCTORAL STIPENDS, 1973-74

(FIGURES IN PARENTHESES ARE PERCENTAGES)

	TOTAL STIPENDS PAID (DOLLARS)						
	NATIONAL RESEARCH COUNCIL	MEDICAL RESEARCH COUNCIL	CANADA COUNCIL	HOST UNIVERSITY	OTHER GRANTING AGENCIES	NOT REPORTED	TOTAL VALUE OF STIPENDS
HUMANITIES AND SOCIAL SCIENCES	80,712 (68.5)	7,410 (6.3)		15,683 (13.3)	14,026 (11.9)		117,831 (100.0)
PHYSICAL SCIENCES	1,636,501 (65.4)	417 (0.0)	7,347 (0.3)	431,929 (17.3)	307,777 (12.3)	116,981 (4.7)	2,500,952 (100.0)
MATHEMATICAL SCIENCES	280,515 (74.3)		6,000 (1.6)	61,350 (16.3)		29,583 (7.8)	377,448 (100.0)
ENGINEERING	358,554 (70.5)	7,875 (1.5)		54,302 (10.7)	83,534 (16.4)	4,300 (0.8)	508,565 (100.0)
LIFE SCIENCES	301,393 (49.4)	142,246 (23.3)		54,999 (9.0)	89,431 (14.6)	22,550 (3.7)	610,619 (100.0)
HEALTH SCIENCES	17,120 (2.7)	360,562 (57.3)		47,032 (7.5)	204,168 (32.5)		628,882 (100.0)
TOTAL	2,674,795 (56.4)	518,510 (10.9)	13,347 (0.3)	665,295 (14.0)	698,936 (14.7)	173,414 (3.7)	4,744,297 (100.0)

monies (down from 18% in 1969-70) and 15% of the total came from "other granting agencies".

Over two-thirds of the stipend funds in the humanities and social sciences came from NRC. The other major sources in this discipline were the universities and "other granting agencies". A similar pattern was evident in the physical sciences and in engineering. Nearly three-quarters of the monies in the mathematical sciences was contributed by NRC. In the life sciences nearly 50% was received from NRC and an additional 23% from MRC. In the health sciences the universities only contributed about 8% of the stipend monies. The heavy contributors in this discipline area were MRC and "other granting agencies" with 57% and 33% respectively.

It can be seen from these figures that the universities are heavily dependent on outside agencies for support of their post-doctoral fellows, even more so than was the case in 1969-70.

Expenditures on Post-doctoral Education

In this section an attempt is made to estimate the operating expenditures incurred by the Ontario universities in support of their post-doctoral fellows. This exercise was undertaken in the 1969-70 study and is repeated in the present study to examine the increase in these expenditures over the five-year period. There is, therefore, greater emphasis placed on the magnitude of the change between 1969-70 and 1973-74 than on the actual expenditure

values developed. Accordingly, there has been no attempt made at estimating a value for the contributions made by the post-doctoral fellows in the universities (with the exception of their teaching service). By definition, the major emphasis in post-doctoral appointments is on research and undoubtedly post-doctoral fellows make considerable contributions in this area. However, in designing this study it was felt that it would not be feasible to attempt to derive a monetary value for this contribution.

It must be stated at the outset that the figures developed in this section are only approximate values. As no detailed cost study was available it was necessary to estimate many of the expense components. Furthermore, only expenditures from the operating budgets of the universities have been considered. No attempt was made to include any capital expenditures incurred by the post-doctoral fellows. For this reason the figures developed in this section are probably on the low side.

For reasons of comparability, the methodology employed in estimating expenditures on post-doctoral education in 1973-74 is similar to the methodology used in the 1969-70 study. Data on operating expenditures in the Ontario universities in 1973-74 were obtained from the annual publication of the Committee of Finance Officers - Universities of Ontario[6]. (Only those Ontario universities who reported having post-doctoral fellows in 1973-74 were included in the subsequent analysis.)

A brief outline of the methodology used in this section is

given before the actual figures are derived. Expenditures associated with post-doctoral education fall into two categories, direct and indirect. The monies paid out as post-doctoral stipends fall into the category of direct expenditures. A substantial portion of these monies is received from outside granting agencies but a significant contribution is also made by the universities themselves. A second direct expenditure is academic staff salaries. It has been seen that post-doctoral fellows are in regular contact with their mentors and, to a lesser degree, with other members of the academic staff. A portion of these salaries must be assigned to the post-doctoral fellows. (It should be pointed out that faculty members derive many benefits from the presence of post-doctoral fellows. Duties assigned to the post-doctorals lighten the load on faculty members and permit more effective use of their time. This may, in fact, offset a substantial portion of the academic salaries expenditures assigned to post-doctoral fellows. It has not been possible, however, to consider this factor in this study). The direct expenditures in both cases are calculated on a per post-doctoral fellow basis.

Under the category of indirect expenditures we have overhead costs associated with student services, central administration, miscellaneous non-academic expenses, non-salary academic expenses, library services, academic computing and plant maintenance. In distributing these indirect monies, the assumption is made that all students within the university must bear a portion of the costs of these

services and, therefore, the assessments of the portions to be assigned to the post-doctoral fellows is based on their representation in the total student body. In some cases it has seemed more appropriate to use weighted students in the calculations. Subtracted from these expenditures is a calculated dollar value for the teaching service performed by the post-doctoral fellows. It must be pointed out that there are many additional contributions made by the post-doctoral fellows but, in the context of this study, it was not deemed feasible to attempt to derive a monetary value for these services.

Before we can begin estimating the expenditures on post-doctoral education it is first necessary to calculate the number of full-time equivalent (FTE) post-doctoral fellows in the Ontario universities during 1973-74. The departmental chairmen were asked to indicate for each of their post-doctoral fellows the number of months that the post-doctoral appointment was held during the study period. From the responses it was calculated that the 835 post-doctoral fellows reported were present for a total of 6,709 man-months. Assuming that a post-doctoral appointment is normally for a full 12-month period, we then have:

$$\text{Total FTE post-doctoral fellows} = \frac{6,709}{12} = 559.1$$

1) Expenditures on post-doctoral stipends

The first expenditure to be estimated is the money paid as post-doctoral stipends and the portion of this that should be

allocated to the universities. In Table 12, it was seen that a total of $4,744,297 was paid out in stipends to the 793 post-doctoral fellows whose stipends were reported (Table 10). From the departmental returns it was calculated that these fellows were present for 6,399 man-months during the study period and therefore,

$$\text{FTE post-doctorals} = \frac{6,399}{12} = 533.3$$

$$\text{Average annual stipend} = \frac{\$4,744,297}{533.3} = \$8,896$$

To determine the portion of this amount that was contributed by the universities it was assumed that the $173,414 shown under the "not reported" category in Table 12 could be split among the remaining categories in the proportions of the reduced total that these categories now represented. As a result of this operation, the stipend monies paid by the universities represented 14.6% of the total stipend monies. Therefore, the portion of the average annual stipend which was contributed by the universities is:

$$\$8,896 \times 0.146 = \$1,299$$

2) Expenditures on student services, central administration, miscellaneous non-academic expenses, and non-salary academic expenses

The operating expenditures of the thirteen participating universities will now be examined to determine what portion of

these expenditures should be attributed to post-doctoral fellows. The COFO-UO financial report showed expenditures in 1973-74 of $89,070,000 for student services, central administration, miscellaneous non-academic expenses, and non-salary academic expenses. It would seem reasonable that these monies should be apportioned on a per FTE student basis. In these areas post-doctoral fellows probably make the same demands (on average) on the university facilities as the other students attending the university. According to final statistics from the Ministry of Colleges and Universities, in 1973-74 there were 141,834.4 eligible FTE students in the thirteen universities. Adding the FTE post-doctoral fellows to this we then have:

$$\text{Total FTE enrolment} = 141,834.4 + 559.1 = 142,393.5$$

and the expenditure per FTE student for the above services is:

$$\frac{\$89,070,000}{142,393.5} = \$626$$

3) Expenditures on library services and academic computing

In 1973-74, the thirteen universities showed expenditures of $52,882,000 for library services and for academic computing. It was assumed that usage in these areas would be dependent on programme and level in programme and that, therefore, the students should be weighted in some fashion. It was decided that the system of weighting employed in the operating grants formula

would be used; according to MCU there were 240,000.5 weighted students (or BIU's) in the thirteen universities in 1973-74. It was felt that the post-doctoral fellows should be given the same weight as PhD students (a weight of 6) which gives:

Total BIU's = 240,000.5 + (559.1 x 6) = 243,355.1

The expenditure on library services and academic computing per weighted student then becomes:

$$\frac{\$52,882,000}{243,355.1} = \$217$$

This gives an expenditure per post-doctoral fellow of:

$\$217 \times 6 = \$1,302$

4) Expenditures on plant maintenance

As was done in the 1969 study, the interim capital formula weighting will be used as the basis for distributing plant maintenance expenditures, again assigning the post-doctorals the same weight as PhD students (in this case a weight of 4). The total space entitlement for the thirteen universities as reported by MCU was 11,886,977 net assignable square feet. (This figure was based on enrolment projections for 1972-73. As a capital freeze on new buildings was imposed in 1972, this figure is a good approximation of the available space in 1973-74.) This total space entitlement, when divided by the space allowance of 96

net assignable square feet per weighted student, gives a total of 123,822.7 weighted students. Adding in the post-doctoral fellows, we have:

Total weighted students = 123,822.7 + (559.1 x 4) = 126,059.1

The capital formula however does not include health sciences space. It was therefore necessary to reduce the plant maintenance expenditures (as presented in the COFO-UO report) in proportion to the number of weighted students in the health sciences (using the weights of the operating grants formula). This resulted in plant maintenance expenditures of $57,182, 462. The expenditure per weighted student is then:

$$\frac{\$57,182,462}{126,059.1} = \$454$$

The resulting expenditure per post-doctoral fellow becomes:

$454 x 4 = $1,816

5) Expenditures on academic staff salaries

The post-doctoral fellows must also bear a portion of the academic salaries. It is unlikely that they contributed in a substantial way to formal instructional costs in the universities but it is reasonable to assume that they did spend considerable time in consultation with members of the academic staff. This information was not readily obtainable in the present study; it was therefore necessary to use figures from the 1969-70 study.

TABLE 13

POST-DOCTORAL CONTACT WITH ACADEMIC STAFF

1969-70

	ACADEMIC RANK OF MENTOR	AVERAGE CONTACT HOURS/WEEK	PERCENTAGE OF PDF'S REPORTED
A.	CONTACT WITH MENTOR:		
	PROFESSOR	3.0	66.4
	ASSOCIATE PROFESSOR	4.5	26.5
	ASSISTANT PROFESSOR	4.9	6.6
	NOT INDICATED	1.0	0.5
	TOTAL	3.5	100.0
B.	CONTACT WITH OTHER ACADEMIC STAFF:	2.8	50.0

Table 13 presents the average contact hours per week for each academic rank and the time spent in contact with faculty other than the post-doctoral fellows' mentors.

We will first look at the time spent in contact with mentors. The weekly contact hours for each academic rank can be calculated by using the equation:

$$\text{Total contact hours/week} = \frac{\text{Percentage of post-doctorals reported}}{100} \times \text{Total number of post-doctorals} \times \text{Average contact hours/week}$$

Values for percentage of post-doctorals reported and average contact hours/week were obtained from Table 13. The total contact hours/week are then:

Professor: $\frac{66.4}{100} \times 835 \times 3.0 = 1663.3$

Associate Professor: $\frac{26.5}{100} \times 835 \times 4.5 = 995.7$

Assistant Professor: $\frac{6.6}{100} \times 835 \times 4.9 = 270.0$

Not Indicated: $\frac{0.5}{100} \times 835 \times 1.0 = 4.2$

It is then possible to compute the expenditures for the time spent in contact with post-doctoral fellows for each academic rank using the following equation:

$$\text{Expenditures} = \frac{\text{Total contact hours/week}}{\text{Average work week}} \times \text{Annual compensation}$$

Values for average compensation were obtained by increasing the

average salary figures reported in Table 11 by 9.5% (this was the value reported for fringe benefits under "Instruction and Research" in the COFO-UO report). Figures for the average work week were based on a study conducted at the University of Toronto [7]. The expenditures for each academic rank are then:

Professor:	$\frac{1663.3}{48.3}$ x $29,048	= $1,000,322
Associate Professor:	$\frac{995.7}{46.6}$ x $20,708	= $ 442,467
Assistant Professor:	$\frac{270.0}{45.3}$ x $16,539	= $ 98,577
Not Indicated:	$\frac{4.2}{46.8}$ x $21,594	= $ 1,940
Total:		$1,543,306

In computing the value in the "not indicated" category, the annual compensation figure used was the weighted average of the above three ranks.

The calculated total is based on the assumption that the 835 post-doctoral fellows were present for 835 x 12 = 10,020 man-months; in actual fact these fellows represented only 6,709 man-months and the total expenditure is reduced to:

$$\$1,543,306 \times \frac{6,709}{10,020} = \$1,033,337$$

The expenditure per post-doctoral fellow is then:

$$\frac{\$1,033,337}{835} = \$1,238$$

In Table 13 it was shown that post-doctoral fellows were

also in contact with faculty other than their mentors; a figure must be derived for this consultation as well. As only 50% of the post-doctorals indicated such contact it will be assumed that the remaining fellows did not in fact have any significant contact with faculty other than their mentors. For the purposes of assessing costs it will be assumed that 50% of the 835 post-doctoral fellows were in contact with other faculty members for an average of 2.8 hours per week. We then have:

$$\text{Total contact hours/week} = \frac{50}{100} \times 835 \times 2.8 = 1{,}169$$

It will be further assumed that faculty holding the ranks from lecturer to full professor were represented in this group; average values for annual compensation and average work week were calculated for this group. The expenditures for the post-doctorals' contact with other faculty becomes:

$$\text{Expenditure} = \frac{1169}{46.3} \times \$20{,}830 = \$525{,}924$$

On reducing this figure for the number of man-months that the post-doctoral fellows were actually present, the expenditure is then:

$$\$525{,}924 \times \frac{6{,}709}{10{,}020} = \$352{,}138$$

The expenditure per post-doctoral fellow becomes:

$$\frac{\$352{,}138}{835} = \$422$$

The portion of academic salary expenditures which must be apportioned to each post-doctoral fellow is then:

$$\$1,238 + \$422 = \$1,660$$

6) Value of post-doctoral teaching

Before calculating the total expenditure it is necessary to derive a dollar value for the teaching service of the post-doctoral fellows. In Table 8 it was noted that the departmental chairmen had estimated that 90.4 additional teaching staff would have been needed to replace the teaching performed by the post-doctorals at a cost of $1,350,545. This represents an average salary of $14,940. Assuming that the replacement staff hired would have been lecturers, assistant professors and associate professors, the University of Toronto study showed an average work week for these ranks of 45.41 hours of which 23.31 hours (51.3%) were devoted to instructional duties. The actual replacement value of the post-doctoral teaching becomes:

$$\$1,350,545 \times 0.513 = \$692,830$$

The replacement value per FTE post-doctoral fellow is then:

$$\frac{\$692,830}{559.1} = \$1,239$$

7) Net expenditure on post-doctoral education

It is now possible to determine the net expenditure on post-doctoral education and the portion of this expenditure that is borne by the university.

Stipends	$ 8,896
Student services, central administration, etc.	626
Library services and academic computing	1,302
Plant maintenance	1,816
Academic staff salaries	1,660
Total	$14,300
Less - teaching service	1,239
Net Expenditure	$13,061

8) Net expenditure to the universities

This cost is determined by replacing the amount shown above under stipends by $1,299 which is the portion of the stipend contributed by the university. This results in a net expenditure to the universities of $5,464 per post-doctoral fellow.

The net operating expenditure associated with post-doctoral education in 1973-74 was $13,061 per post-doctoral fellow of which on average 41.8% was contributed by the host university. Therefore, since 1969-70 the net expenditure per post-doctoral fellow increased by 25% while the university portion increased by 15%.

Footnotes

1. L.C. Payton, Post-doctoral Education in the Ontario Universities 1969-70, Council of Ontario Universities, Toronto, 1972.

2. Source: Reports from the Ministry of Colleges and Universities of Ontario.

3. L.C. Payton, Canadian Association of Graduate Schools 1974 Statistical Report, Council of Ontario Universities, Toronto, 1974.

4. Annual Report on Scholarships and Grants in Aid of Research 1973-74, National Research Council of Canada, Ottawa.

5. M.A. Preston, Canadian Association of Graduate Schools Employment of New PhD Graduates 1973-74, Unpublished appendix, Council of Ontario Universities, Toronto, 1974.

6. Total Revenue and Expenses for Provincially Assisted Universities of Ontario for the Fiscal Year Ended April 30, 1974, Committee of Finance Officers - Universities of Ontario, Council of Ontario Universities, Toronto, 1974.

7. B.L. Hansen and S. Sandler, Report on a Study of Faculty Activities at the University of Toronto, Office of Institutional Research, University of Toronto, Toronto, 1967.

APPENDIX A

Questionnaire

INSTRUCTIONS FOR COMPLETION OF PAGES 2
AND 3 OF THE DEPARTMENTAL QUESTIONNAIRE

INSTRUCTIONS FOR PAGE 2

For each post-doctoral in your department please fill out one line on Page 2 of this questionnaire. We would ask you to provide information for as many of the listed items as possible.

Where needed, explanations for the items are given below:

Item 1 - Year Doctorate Awarded

Indicate the year in which the post-doctoral fellow was awarded the doctoral degree. For those post-doctoral fellows in the basic science departments whose highest degree is the MD, indicate the year in which this degree was awarded and also indicate that the degree was the MD.

Item 2 - Appointment Start Date

Indicate the month and year in which the post-doctoral fellow began his post-doctoral appointment in your department. If more than one consecutive appointment has been held in your department by the fellow, the start date of the first appointment is required.

Item 3 - Appointment Finish Date

Indicate the month and year in which the post-doctoral fellow terminated, or will terminate, his present post-doctoral appointment in your department. If this date is on or after April 30, 1974, indicate the finish date as April, 1974.

Items 4 and 5 - Annual Stipend and Granting Agency

List all stipends (or awarded salaries, fellowships or payments for teaching) on an annual basis (whether or not the fellow was present for the full 12-month period) and the granting agency in each case pertaining to the present post-doctoral appointment. Use as many lines on the form as are nesessary for this item. Please use the designations for the granting agencies as listed below:

NRC	(National Research Council)
MRC	(Medical Research Council)
CC	(Canada Council)
HOST	(Host university funds)
OTHER*	(All other granting agencies)

* If there is more than one granting agency in this category, the figures may be grouped.

NOTE: All stipend figures should be on a "before deductions" basis.

Item 6 - Mentor's Rank

Please indicate the academic rank of the post-doctoral fellow's mentor, using the designations indicated below:

PROF	(Full Professor)
ASSOC	(Associate Professor)
ASST	(Assistant Professor)
OTHER	(All other academic ranks)

Item 7 - Country of Citizenship

Please indicate the country of citizenship of the post-doctoral fellow, using the designations indicated below:

Canada
U. S. A.
U. K.
Europe
Asia
Africa
Other

Item 8 - Visa Status

For those post-doctoral fellows who were not listed as Canadian citizens in the preceding item, please indicate if their visa status was:

LI	(Landed Immigrant)
OTHER	(All other visas)

A sample page illustrating the method of completing Page 2 of the questionnaire has been included for clarification of the above notes.

INSTRUCTIONS FOR PAGE 3

For each of the post-doctoral fellows list ! on Page 2 of the questionnaire, please indicate the fellow's surname and initials. This list is to be sent to the Graduate School of your university along with your completed forms. The Graduate School will compile a master list (arranged in a random order) from all the departmental lists. Only this master list will be forwarded to the Council of Ontario Universities. This procedure is being employed as a means of checking that a post-doctoral fellow is not counted twice in the survey if he transfers from one Ontario university to another during the study period, while at the same time ensuring that data on individuals will remain anonymous.

DEPARTMENTAL QUESTIONNAIRE

Institution _____ Department _____

Year Doctorate Awarded	Appointment Start Date month	year	Appointment Finish Date month	year	Annual Stipend $	Granting Agency	Mentor's Rank	Country of Citizenship	Visa Status	DO NOT WRITE IN THIS AREA ID	YR	LEN	DUR	MR	CC	VS	AS	GA	AS	GA	AS	GA

LIST OF POST-DOCTORAL FELLOWS

Institution _____ Department _____

Surname	Initials	Surname	Initials

APPENDIX B

Departments Within Major Discipline Areas

Departments Within Major
Discipline Areas

Humanities and Social Sciences:

Psychology
Sociology & Anthropology

Physical Sciences:

Aerospace Studies
Astronomy
Chemistry
Experimental Space Science
Geology
Geophysics
Land Resource Science
Matallurgy & Materials Science
Physics

Mathematics:

Applied Analysis & Computer Science
Applied Mathematics
Combinatorics & Optimization
Computer Science
Mathematics
Mathematics & Statistics
Pure Mathematics
Statistics

Engineering:

Chemical
Civil
Electrical
Engineering Science
Mechanical

Life Sciences

Animal & Poultry Science
Biochemistry
Biology
Biomedical Sciences
Biophysics
Botany
Botany & Genetics
Crop Science
Environmental Biology
Plant Sciences
Zoology

Health Sciences:

Anatomy
Bacteriology & Immunology
Clinical Biochemistry
Epidemiology & Preventative Medicine
Hygiene
Immunology
Medical Biophysics
Microbiology
Microbiology & Immunology
Neurosciences
Pathology
Pharmacology
Pharmacy
Physiology